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ABSTRACT

DOES AID EFFECTIVENESS DEPEND ON THE QUALITY OF DONORS?

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The question of whether aid recipient countries would benefit from stronger income effects if foreign donors provided higher quality aid has received scant attention so far. We make use of the ranking of donors by the Center for Global Development to compare the effects of quality-adjusted aid and unadjusted aid on changes in GDP per capita. Our difference-in-difference-in-differences analysis reveals significant treatment effects for quality-adjusted aid, while we do not find significant treatment effects for unadjusted aid. The quality of aid matters most when accounting for delayed effects. However, our results depend on the sample of recipient countries.

Keywords: donor ranking, quality-adjusted aid, income effects, DDD analysis
JEL classification: F35

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1. Introduction

It has been intensively and controversially discussed whether 'good' economic policies and governance in the *recipient* countries render foreign aid more effective in alleviating poverty and stimulating economic growth.[1] Considerably less attention has been paid to the question of how *donor* policies could enhance the effectiveness of aid, even though the recent literature offers several indications that the source of funding matters. Specifically, it appears that the effects of aid depend on political characteristics of the donors, the motives underlying their aid, and complementary (non-aid) policies.

Concerning political characteristics, Bermeo (2011) finds that aid from democratic donors promotes democratization in the recipient countries, whereas aid from authoritarian donors is negatively associated with democratization. According to Dreher et al. (2015), political misalignment and greater ideological distance between donor and recipient governments reduces the growth effects of aid by adding to transaction costs and eroding trust.

Focusing on trade-related motives of aid, Berthélemy (2006) differentiates between selfish and altruistic donors. Based on such classifications from the aid allocation literature, Minoiu and Reddy (2010) distinguish the growth effects of so-called developmental and non-developmental aid.[2] However, the donor classifications used by Minoiu and Reddy (2010) tend to be ad hoc and are typically time invariant. Strategic and geopolitical motives of donors are also likely to erode the effectiveness of aid. Headey (2008), Bearce and Tirone (2010), and Bermeo (2016) consider aid to be geopolitically motivated under Cold War conditions. Dreher et al. (2016) show that aid is less effective

[1] The role of the recipient countries' policies and institutions has been stressed by the World Bank (1998) and Burnside and Dollar (2000). Skeptical assessments include Easterly et al. (2004) and Rajan and Subramanian (2008).

[2] Minoiu and Reddy (2010) find that only developmental aid promotes economic growth in the recipient countries. In a similar vein, Kilby and Dreher (2010) find that the growth impact of aid that addresses recipient needs differs from the impact of aid that is motivated by donor interests.

in promoting growth when recipient countries are strategically important as temporary members of the UN Security Council (UNSC).[3]

The effectiveness of aid may also depend on complementary donor policies. For instance, empirical evidence presented by Minasyan and Nunnenkamp (2016) suggests that higher remittances paid by donor countries, proxying for worker mobility and migration, strengthen the growth effects of aid. Instead of assessing conditional aid effects, Gary and Maurel (2015) construct a measure of donors' policy consistency which includes aid as one of seven elements.[4] They find that more consistent donor policies are associated with higher growth in the recipient countries.

In contrast to Gary and Maurel (2015), we focus on the quality of the donors' *aid policies* in the following. Our analysis thus resembles the distinction between developmental and non-developmental aid by Minoiu and Reddy (2010). However, we employ a time varying measure of the quality of donors to address the question of whether the income effects of aid depend on the source of funding. Specifically, we make use of the periodical ranking of donors by Roodman (2012) which is available from the Center for Global Development on an annual basis since 1995.[5] Roodman's ranking covers various aspects of aid-related policies, e.g., by discounting tied aid, adjusting for selective aid allocation, penalizing project proliferation, and rewarding tax policies to support private giving.

Accounting for aid-related policies and adjusting nominal aid disbursements accordingly results in a measure of 'effective' donor support that may deviate substantially from the aid figures typically applied in previous studies on the aid-growth nexus. At the same time, the deviation between quality-

[3] Dreher et al. (2013) come to similar conclusions when investigating the effect of UNSC membership on the evaluation of World Bank projects.
[4] All elements (aid, trade, migration, investment, technology, security, and environment) are part of the Center for Global Development's Commitment to Development Index (for details see: http://www.cgdev.org/cdi-2015).
[5] We are most grateful to David Roodman for sharing his data.

adjusted aid and nominal aid varies considerably across donors and over time (for details see Section 2). Consequently, the income effects in the recipient countries are likely to depend on the composition of donors contributing to overall aid inflows. Against this backdrop, we hypothesize that it is quality-adjusted aid, rather than nominal aid, from which recipient countries might benefit in terms of higher GDP per capita. Based on Roodman (2012) we calculate the effective amount of quality-adjusted aid that recipient countries receive from donors of the Development Assistance Committee (DAC). Our difference-in-difference-in-differences analysis reveals significant treatment effects for quality-adjusted aid, while we do not find significant treatment effects for unadjusted aid. Hence, we offer new empirical evidence for the notion that even though nominal amounts of aid might not affect growth, development cooperation can still have positive income effects if donors improve the quality of their aid.

2. Approach and data

We perform a difference-in-difference-in-differences (DDD) analysis to assess whether the income effects of aid depend on the quality of donors providing aid to recipient country *j* at time *t*.[6] Our dependent variable is the difference in GDP per capita (*GDPpc*) between two points in time, as reported in the World Bank's World Development Indicators database. *GDPpc* is logged before differencing.

As noted before, the treatment is based on a measure of quality-adjusted aid that makes use of Roodman's (2012) donor ranking and accounts for the time varying composition of donors contributing

[6] The description of the DDD approach draws on Nunnenkamp and Öhler (2011).

to overall aid flows to a particular recipient country. Roodman's account of aid-related policies affects effective donor support to varying degree. Comparing the 28 DAC donor countries in our sample, Sweden provides aid of highest quality, whereas the Slovak Republic represents the taillight. Net aid disbursements[7] are on average discounted by 44 percent for Sweden, compared to 77 percent for the Slovak Republic (Figure 1). Moreover, as can be seen from Figure 2, the discount factor varies considerably over time for individual donors.

While the discount factor varies across donors and over time, it applies to all recipient countries. Our measure of quality-adjusted aid uses the donor-specific discount factors at time *t* to adjust each donor's bilateral aid disbursements to particular recipient countries at time *t*. As a result, the variation of quality-adjusted aid across recipient countries stems from varying contributions of specific donors to the recipient's overall aid inflows at different points in time.

Unadjusted aid flows to country *j* at time *t*, used for reasons of comparison, are (net) disbursements in constant prices of 2012 as available from the OECD-DAC aid database.[8] The aid variables are defined in total US$ or, alternatively, per capita of the recipient countries' population (see below for details).

The DDD approach combines before-after comparisons and with-without comparisons of the difference in *GDPpc*. This combination helps mitigate the limitations of both types of comparison when used in isolation. The simple before-after approach would compare the difference in *GDPpc* in aid recipient countries prior and subsequent to a distinct change in donor behavior. Clearly, the implicit assumption that no other omitted variable might have affected our dependent variable over time is unlikely to hold. The simple with-without alternative of comparing the difference in *GDPpc* between

[7] In calculating the discount rate we follow Roodman (2012) and use his net aid measure.
[8] http://stats.oecd.org/index.aspx?DataSetCode=CRS1 (accessed: May 2016).

countries benefitting from the change in donor behavior and those not benefitting would ignore that our dependent variable might have developed differently in the treatment and control groups due to factors unrelated to aid.

The DDD estimator removes any fixed country effects (first differences) and any fixed time trends (second differences). The great appeal of DDD analysis "comes from its simplicity as well as its potential to circumvent many of the endogeneity problems that typically arise when making comparisons between heterogeneous individuals" (Bertrand *et al*. 2004: 249), even though concerns about causal inference are not necessarily resolved completely.[9]

Our period of observation is 1999-2011. The limiting factor is the assessment of the donors' quality which is not available for more recent years. We divide this period into two equally long sub-periods, i.e., 1999-2005 and 2005-2011 ('before' and 'after').[10] Taking 2005 as the dividing line between 'before' and 'after' appears to be most plausible, considering the Paris Declaration on Aid Effectiveness being issued this year, which committed the donors to improve the quality and, thus, the effectiveness of aid.[11] What is more, major initiatives such as the UN Millennium Project (UNDP 2005) and the Commission for Africa (2005) argued for intensified donor efforts and a concentration of aid on the particularly needy. Also, at the G8 Summit in Gleneagles in 2005, political leaders agreed to substantially increase aid by about US$ 50 billion per annum (by 2010) and to double aid to Africa

[9] See also Meyer (1995) for a detailed discussion.
[10] However, as explained in more detail below, we account for delayed effects of the aid treatment by using more recent years for calculating the change in *GDPpc*.
[11] For details of the Paris Declaration see: http://www.oecd.org/dac/effectiveness/34428351.pdf (accessed: May 2016).

(http://www.unmillenniumproject.org/press/g8overview.htm). Indeed, overall aid disbursements increased considerably after 2005.[12]

The with-without dimension of the DDD approach distinguishes between recipient countries with high increases in quality-adjusted aid and recipient countries with low increases or declines in quality-adjusted aid (treatment group, *T*, versus control group, *C*). We take the median of the difference between mean aid inflows during the 1999-2004 period and mean aid inflows during the 2006-2011 period as the dividing line between the treatment and control groups.[13] Alternatively, we exclude countries around the median and compare the top and bottom tercile of our sample.

Formally, the DDD estimator for our baseline specification is as follows:[14]

$$DDD = ((GDPpc^{T}_{2011} - GDPpc^{T}_{2005}) - (GDPpc^{C}_{2011} - GDPpc^{C}_{2005})) \\ - ((GDPpc^{T}_{2005} - GDPpc^{T}_{1999}) - (GDPpc^{C}_{2005} - GDPpc^{C}_{1999}))$$

The estimator corresponds to the coefficient of the interaction term between the dummy variable for the treatment group and the dummy variable for the second period in the basic regression specification without additional control variables. In extended specifications, we add the (logged) level of *GDPpc* at the beginning of the first and second periods. In this way we take into account that changes in *GDPpc* may depend on initial levels. Furthermore, we control for the (logged) rate of inflation as an indicator of economic stability, the ratio of imports plus exports over GDP as an

[12] Total aid disbursements in constant prices increased by about 50% when comparing period averages for 1999-2004 and 2006-2011.

[13] Countries in the treatment group, on average, experienced a considerable increase in quality-adjusted aid, whereas countries in the control suffered a decline (see Appendix table 2). In per-capita terms, the increase in quality-adjusted aid amounted to 28 US$ for the treatment group when comparing the second period with the first period, compared to a decline by about 9 US$ for the control group. Note that we exclude 2005 for the calculation of average annual aid flows since this year is the dividing line between the sub-periods before and after the change in donor behavior.

[14] While our aid measure is based on average annual flows during 6-year sub-periods, our dependent variable is the difference in the level of GDP per capita during the 6-year sub-periods 1999-2005 and 2005-2011.

indicator of openness to trade, and control of corruption as an indicator of good governance – all at the beginning of the first and second periods.[15] Moreover, we control for disbursements of multilateral aid as a share of total aid, since our measure of quality-adjusted aid covers only bilateral DAC donors.

The identifying assumption of our DDD estimator is that, in the absence of the aid-related treatment, the difference in the dependent variable between the two sub-periods would have been the same for the treatment and the control groups. As argued by Abadie (2005), the plausibility of this assumption is open to question if the treatment and control groups differ with regard to factors that may be associated with the dynamics of the dependent variable. Therefore, we include interaction terms between the control variables and the dummy variable for the second period to control for time-varying country-specific factors.

The fully specified regression equation reads as follows:

$$\Delta GDPpc_{it} = \alpha_0 + \beta Treatment_i + \gamma 2nd\ period_t + \delta(Treatment*2nd\ period)_{it} + \lambda \mathbf{X_{it}} + \rho(\mathbf{X}*2nd\ period)_{it} + \varepsilon_{it}$$

The coefficient δ of the interaction between the dummy variables of the treatment group and the second period is of principal interest to assess our hypothesis that it is quality-adjusted aid, rather than unadjusted nominal aid, from which recipient countries benefit in terms of increases in GDP per capita. The hypothesis implies that δ is significantly positive when the treatment is based on the difference of quality-adjusted aid, while δ would be statistically insignificant when the treatment is based on the difference of unadjusted aid as reported by the OECD's Development Assistance Committee. In contrast, δ would be statistically insignificant independent of whether the treatment is based on the

[15] The data on inflation and trade are from the World Bank's World Development Indicators. Control of corruption is from the World Bank's Worldwide Governance Indicators.

difference of quality-adjusted aid or unadjusted aid if it made no difference for recipients that aid is granted according to the criteria used in Roodman's (2012) measure.[16]

3. Results

Baseline results

Table 1 presents our baseline results on the effects of aid on the change in GDP per capita for the full sample of recipient countries.[17] We use the median of the difference in aid between the first and second periods to separate the treatment and control groups. The difference in aid is based on inflows in total US$ in the upper panel of Table 1 and, alternatively, on inflows per capita in the lower panel of Table 1. We prefer the first measure since donors are expected to decide on absolute aid amounts when distributing their overall aid budget across recipient countries.[18] Since small recipient countries typically receive higher aid inflows per capita (e.g., Neumayer 2003), they are more likely to fall into the treatment group when donors scale up aid and the treatment is defined in per-capita terms.

We proceed in three steps to compare the treatment effects of quality-adjusted aid (columns 1-3) with the treatment effects of unadjusted aid (columns 4-6). In the first step, we perform the basic DDD estimations without any additional control variables (columns 1 and 4). We then include the control variables introduced in Section 2 (columns 2 and 5). Finally, we also interact the control variables with

[16] Standard errors are clustered by recipient country.
[17] It should be noted that we excluded two outliers throughout our empirical analysis: Libya and Equatorial Guinea. While Libya's GDP per capita suffered an exceptionally steep decline in 2011 (Libyan Civil War), the increase in Equatorial Guinea's GDP per capita was exceptionally large in 2008, i.e., shortly after the discovery of large oil reserves.
[18] Our results stay robust if we control for the population of recipient countries. Results are available upon request.

the dummy variable for the second period (columns 3 and 6).[19] For the sake of brevity, we do not show the coefficients on the control variables and their interactions with the dummy variable for the second period. While the signs of the control variables are generally as expected, they typically do not reach statistical significance at conventional levels.[20] In other words, the control variables do not have a strong impact on the dynamics of our dependent variable during the period of observation.

The insignificant coefficients on the dummy variable for the second period indicate persistent dynamics of our dependent variable throughout the period of observation when considering the whole sample of recipient countries. Likewise, there is no evidence that the dynamics in GDP per capita differed between the treatment and control groups prior to the scaling up of aid, as reflected in the insignificant coefficients on the dummy variable for the treatment group. These results hold independently of whether we consider quality-adjusted aid in columns (1)-(3) or unadjusted aid in columns (4)-(6); they are also independent of whether we use our preferred measure of aid inflows in total US$ in the upper panel of Table 1 or the alternative measure of aid inflows per capita in the lower panel.

However, the upper panel of Table 1 provides strong indications that the treatment effect of increased aid depends on whether aid is quality-adjusted or not. The interaction between the dummy variables for the second period and the treatment group proves to be significant at least at the ten percent level for quality-adjusted aid in columns (1)-(3). What is more, the average treatment effect is quantitatively important. According to the results in column (3), the average effect of 0.063 amounts to 37 percent of the mean change in GDP per capita for the treatment group (see Appendix table 2). In contrast, the

[19] This way we attempt to control for the effects of omitted time-varying and country-specific variables that may be correlated with increased quality-adjusted aid (the treatment):

[20] However, the share of multilateral aid proves to be statistically significant in the fully specified model in columns (3) and (6). Specifically, the change in GDP per capita was positively associated with multilateral aid, though only in the first period.

interaction falls considerably short of reaching significance for unadjusted aid in columns (4)-(6). Taken together, the quality of donors appears to matter for aid effectiveness. Only recipient countries with increased aid inflows of high quality, as revealed by Roodman's (2012) measure, benefit in terms of increasing GDP per capita.

The evidence on the treatment effect of quality-adjusted aid is weaker when considering aid inflows per capita in the lower panel of Table 1. The interaction between the dummy variables for the second period and the treatment group continues to be positive and significant (at the five percent level) in column (1). However, the interaction becomes insignificant when entering the control variables in columns (2) and (3). As noted above, small countries are more likely to fall into the treatment group when the treatment is defined in per-capita terms. This could affect our results if the dynamics in GDP per capita differ between small and large recipient countries. Indeed, closer inspection reveals that particularly small recipient countries (with a population of less than one million) are over-represented in the treatment group when defining the treatment in per-capita terms. At the same time, the difference in GDP per capita was clearly below average for the sub-group of particularly small recipient countries. This provides a first indication that our baseline findings are largely driven by specific groups of recipient countries.[21]

In Table 2, we modify the definition of treatment and control groups and then re-estimate the same set of model specifications as in Table 1. Instead of using the median as the dividing line between treatment and control groups, we widen the gap between treatment and control groups by excluding countries with a change in aid inflows relatively close to the median and comparing the remaining top tercile of sample countries with the bottom tercile. Importantly, previous results on the interaction

[21] We return to this issue below when interpreting the results for restricted samples in Table 3.

between the two dummy variables are hardly affected by this modification.[22] As before, the treatment effect of unadjusted aid proves to be consistently insignificant in columns (4)-(6) of Table 2. The contrast to quality-adjusted aid is again particularly pronounced in the upper panel of Table 2 when using aid inflows in total US$ to separate treatment and controls groups. The results on the interaction terms for quality-adjusted aid in per-capita terms are slightly stronger in the lower panel of Table 2, compared to the corresponding estimations in the lower panel of Table 1.

Restricted samples

The estimations reported in Table 3 are based on restricted samples to assess more systematically whether specific groups of recipient countries are driving our baseline results. For the sake of brevity, we use the preferred measure of aid inflows in total US$ in these estimations to separate the treatment and control groups. In the first panel at the top of Table 3, we exclude 33 countries with a population of less than one million. The results of this exercise underscore the important role of small recipient countries for our baseline findings. The size of the coefficients on the interaction between the dummy variables for the second period and the treatment group still appears to be higher in columns (1)-(3) for quality-adjusted aid than in columns (4)-(6) for unadjusted aid. However, the treatment effects fail to reach statistical significance for quality-adjusted aid, too. This suggests that mainly small recipient countries benefit from being treated with increases in quality-adjusted aid. In sharp contrast, the exclusion of the 30 largest recipient countries in the second panel of Table 3 hardly affects the baseline findings shown in Table 1.

[22] However, the dummy variable for the treatment group proves to be significantly negative in several estimations in Table 2, suggesting that the dynamics of GDP per capita were weaker for countries in the treatment than in the control group during the first period, i.e., before donors scaled up (quality-adjusted) aid.

In the third and fourth panel of Table 3, we exclude 19 so-called Part II countries from the sample.[23] This group was introduced by the OECD's DAC after the end of the Cold War in 1993; it consisted of relatively advanced developing countries and transition economies in Eastern Europe. When the DAC reverted to a single list of aid recipients in 2005, most Part II countries did no longer receive official development assistance and some of them had become new donors. Hence, former Part II countries typically fall into the control group in our estimations. At the same time, the average change in GDP per capita was relatively small for this group.

When excluding Part II countries, the interaction terms between the dummy variables for the second period and the treatment with quality-adjusted aid lose their significance in columns (1) and (2). Importantly, however, the treatment effect for quality-adjusted aid proves to be significantly positive in column (3) where the specification includes both the control variables and their interaction with the dummy variable for the second period.

To summarize, Table 3 reveals that our baseline results are sensitive to sample selection. This is not exceptional in the aid effectiveness literature. For instance, Easterly et al. (2004) challenged the major result of the seminal paper of Burnside and Dollar (2000) that aid has a positive impact on economic growth in recipient countries pursuing sound economic policies. Easterly et al. (2004) show that this result no longer holds when adding additional countries and observations to the dataset of Burnside and Dollar (2000). Clearly, sample selection also deserves closer attention in further research on the role of donor quality for the effectiveness of aid.

[23] In this specification, we only keep countries in our sample that were on the official DAC list of ODA recipients in 2011. This list is revised every three years (for details see http://www.oecd.org/dac/stats/daclist.htm).

Delayed effects

In the final step of our analysis, we consider delayed effects of quality-adjusted aid and unadjusted aid on the change in GDP per capita in the recipient countries. Again, we only report the results based on the preferred measure of aid inflows in total US$. Table 4 shows the results with lags of one year, two years, and three years. Put differently, the change in GDP per capita during the second period no longer relates to 2005-2011 as in our baseline estimations; instead it relates to 2006-2012, 2007-2013, and 2008-2014, respectively. Estimations in the upper three panels of the table are based on the full sample, while estimations in the lower three panels are based on the reduced sample after excluding Part II countries.

The treatment effects of aid on the change in GDP per capita generally become stronger, compared to the baseline results, when accounting for lags. Some interaction terms even turn out to be significant at the ten percent level when the treatment relates to unadjusted aid. However, this applies only to estimations for the full sample in columns (4) and (5). The treatment with unadjusted aid is no longer significant for the fully specified model in column (6), and after excluding Part II countries in the lower panels of Table 4.

What is more, the results in Table 4 indicate consistently that the quality of donors matters for the effectiveness of aid. The size of the coefficients on the interaction terms as well as their significance typically increases compared to the corresponding baseline results. The average treatment effect reaches its maximum of 0.078 with three-years lags for the total country sample in column (3),

compared to the corresponding treatment effect of 0.063 in Table 1. This underscores the quantitative importance of the treatment with quality-adjusted aid.

4. Summary and conclusion

Compared to the intensive debate on the role of policies in the recipient countries for the effectiveness of foreign aid, it has received only scant attention whether aid could induce stronger income effects if donors provided their assistance in higher quality. As argued by Roodman (2012), donors could improve the quality of aid in various ways, inter alia, by untying aid, allocating aid selectively, avoiding project proliferation, and supporting private giving. We use Roodman's ranking of donors along these dimensions to derive quality-adjusted aid inflows for a large sample of recipient countries during the period 1999-2011. We compare the effects of quality-adjusted aid and unadjusted aid as reported by the donors on changes in GDP per capita in the recipient countries by performing a difference-in-difference-in-differences (DDD) analysis.

We find fairly strong indications that quality-adjusted aid is more effective than unadjusted aid in inducing income gains in the recipient countries. The DDD analysis for the overall country sample reveals statistically significant and quantitatively important treatment effects for quality-adjusted aid, while we do not find significant treatment effects for unadjusted aid. Only recipient countries with increased aid inflows of higher quality benefit in terms of increasing GDP per capita. Allowing for a delayed impact on changes in GDP per capita, the treatment effects become stronger, compared to the baseline results, corroborating that the quality of aid inflows matters for aid effectiveness.

However, our baseline results are sensitive to sample selection. In particular, it appears that mainly small recipient countries benefit from being treated with increases in quality-adjusted aid.

Future research may help clarify why it seems to be easier for small recipient countries to benefit from higher quality aid. Possibly, large recipient countries see no choice but to accept aid from all available sources, independent of the donors' quality ranking, in order to meet their perceived financing needs. Such an approach appears to be shortsighted, however, as long as various sources supply low quality aid. The challenge for the donors obviously is to improve the quality of their aid, rather than 'only' scaling up nominal aid budgets. The considerable discounts shown for various donors in Figure 1 and the limited progress, if any, made so far in reducing these discounts reveal the untapped potential for improving the effectiveness of aid in this way. At the same time, further research could pursue two avenues to provide a fuller account of aid-related donor policies. On the one hand, a refined analysis of specific elements of Roodman's donor ranking may offer deeper insights into what exactly influences the effectiveness of quality-adjusted aid. On the other hand, a broader view on donor policies, e.g., with regard to trade liberalization and market access, seems to be required to identify complementarities that may render aid more effective.

Figure 1 – Mean discount factors per donor country (1995-2011)

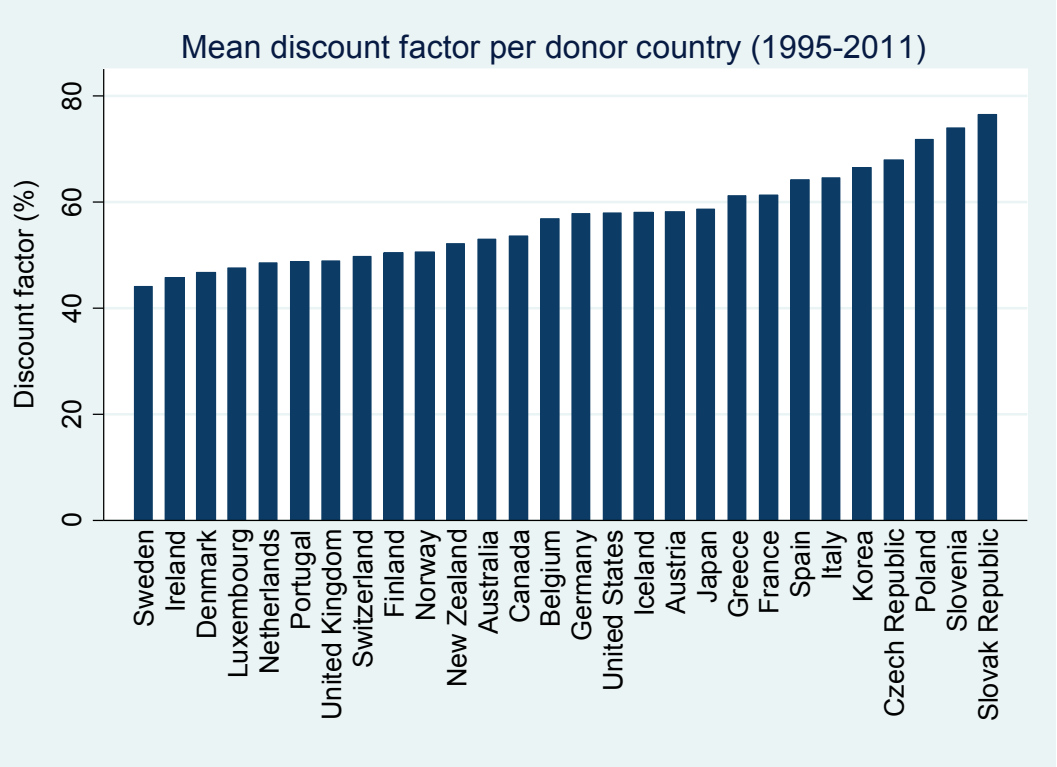

Figure 2 – Discount factor, development for selected donors (1995-2011)

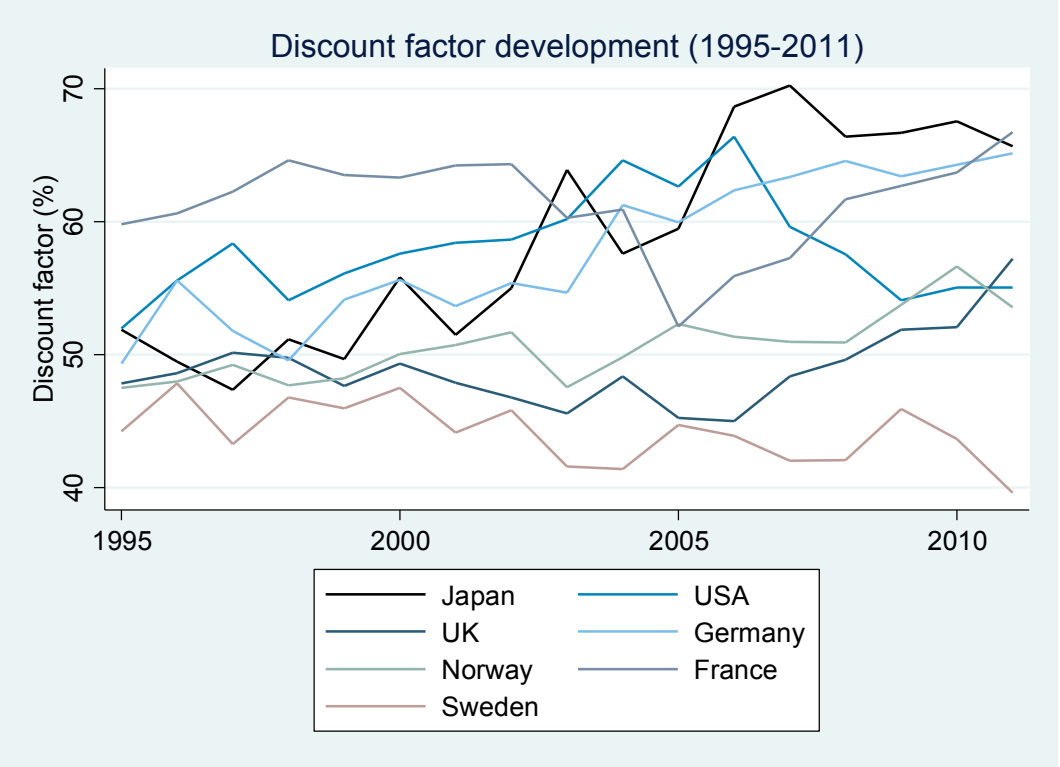

Table 1 – Effects of aid on the change in GDP per capita: full sample, median of difference in aid to separate treatment and control groups

	(1)	(2)	(3)	(4)	(5)	(6)
Variables	Treatment based on change in aid inflows, total US$					
	Quality-adjusted aid			Unadjusted aid		
2nd period	-0.025	-0.013	0.024	-0.006	0.013	0.137
	(0.216)	(0.576)	(0.872)	(0.760)	(0.581)	(0.347)
Treatment	-0.004	-0.009	-0.013	-0.008	-0.026	-0.028
	(0.881)	(0.800)	(0.724)	(0.764)	(0.437)	(0.416)
2nd period * treatment	0.067**	0.055*	0.063**	0.029	0.014	0.013
	(0.017)	(0.066)	(0.047)	(0.297)	(0.653)	(0.667)
Constant	0.150***	0.037	0.030	0.152***	0.102	0.055
	(0.000)	(0.790)	(0.865)	(0.000)	(0.440)	(0.734)
Controls	No	Yes	Yes	No	Yes	Yes
2nd period * controls	No	No	Yes	No	No	Yes
Observations	288	238	238	288	238	238
R^2	0.018	0.037	0.055	0.003	0.030	0.049
	Treatment based on change in aid inflows, per capita US$					
	Quality-adjusted aid			Unadjusted aid		
2nd period	-0.019	-0.006	0.074	-0.012	0.006	0.126
	(0.321)	(0.795)	(0.605)	(0.554)	(0.796)	(0.350)
Treatment	-0.029	-0.049	-0.050	-0.020	-0.029	-0.038
	(0.299)	(0.143)	(0.138)	(0.485)	(0.350)	(0.247)
2nd period * treatment	0.055**	0.048	0.044	0.040	0.026	0.035
	(0.048)	(0.107)	(0.134)	(0.154)	(0.386)	(0.237)
Constant	0.162***	0.129	0.105	0.158***	0.087	0.043
	(0.000)	(0.342)	(0.513)	(0.000)	(0.479)	(0.770)
Controls	No	Yes	Yes	No	Yes	Yes
2nd period * controls	No	No	Yes	No	No	Yes
Observations	288	238	238	288	238	238
R^2	0.008	0.038	0.056	0.004	0.031	0.051

Robust pval in brackets; *** p<0.01, ** p<0.05, * p<0.1

Table 2 – Effects of aid on the change in GDP per capita: full sample, top and bottom terciles as treatment and control groups

Variables	(1)	(2)	(3)	(4)	(5)	(6)
	Treatment based on change in aid inflows, total US$					
	Quality-adjusted aid			Unadjusted aid		
2nd period	-0.044*	-0.025	0.062	0.006	0.014	0.240
	(0.067)	(0.407)	(0.777)	(0.782)	(0.575)	(0.158)
Treatment	-0.060*	-0.084*	-0.095*	-0.033	-0.040	-0.055
	(0.089)	(0.073)	(0.080)	(0.360)	(0.341)	(0.240)
2nd period * treatment	0.095***	0.076*	0.096**	0.038	0.039	0.064
	(0.006)	(0.057)	(0.040)	(0.242)	(0.278)	(0.120)
Constant	0.179***	0.046	0.010	0.170***	0.042	-0.056
	(0.000)	(0.788)	(0.966)	(0.000)	(0.795)	(0.793)
Controls	No	Yes	Yes	No	Yes	Yes
2nd period * controls	No	No	Yes	No	No	Yes
Observations	198	154	154	192	166	166
R^2	0.020	0.096	0.121	0.011	0.070	0.120
	Treatment based on change in aid inflows, per capita US$					
	Quality-adjusted aid			Unadjusted aid		
2nd period	-0.032	-0.009	0.295	0.010	0.010	0.139
	(0.151)	(0.744)	(0.120)	(0.642)	(0.694)	(0.453)
Treatment	-0.069**	-0.086**	-0.077*	-0.012	-0.032	-0.053
	(0.039)	(0.049)	(0.093)	(0.746)	(0.446)	(0.241)
2nd period * treatment	0.095***	0.075*	0.055	0.013	0.027	0.052
	(0.007)	(0.057)	(0.176)	(0.707)	(0.492)	(0.212)
Constant	0.170***	0.185	0.073	0.156***	0.107	0.069
	(0.000)	(0.271)	(0.738)	(0.000)	(0.530)	(0.736)
Controls	No	Yes	Yes	No	Yes	Yes
2nd period * controls	No	No	Yes	No	No	Yes
Observations	204	156	156	190	161	161
R^2	0.024	0.064	0.098	0.003	0.045	0.084

Robust pval in brackets; *** p<0.01, ** p<0.05, * p<0.1

Table 3 – Effects of aid on the change in GDP per capita: restricted samples

Variables	(1)	(2)	(3)	(4)	(5)	(6)
	Smallest countries (population < 1 million) excluded					
	Quality-adjusted aid			Unadjusted aid		
2nd period * treatment	0.039	0.039	0.053	0.016	0.023	0.035
	(0.221)	(0.213)	(0.118)	(0.624)	(0.459)	(0.279)
Controls	No	Yes	Yes	No	Yes	Yes
2nd period * controls	No	No	Yes	No	No	Yes
Observations	221	192	192	221	192	192
R^2	0.017	0.092	0.125	0.003	0.078	0.112
	Largest countries (population > 23 million) excluded					
	Quality-adjusted aid			Unadjusted aid		
2nd period * treatment	0.094***	0.073*	0.081**	0.047	0.019	0.023
	(0.004)	(0.052)	(0.035)	(0.160)	(0.620)	(0.549)
Controls	No	Yes	Yes	No	Yes	Yes
2nd period * controls	No	No	Yes	No	No	Yes
Observations	228	183	183	228	183	183
R^2	0.022	0.060	0.082	0.005	0.049	0.072
	Part II countries excluded; median to separate treatment and control groups					
	Quality-adjusted aid			Unadjusted aid		
2nd period * treatment	0.037	0.046	0.068**	0.015	0.030	0.045
	(0.195)	(0.124)	(0.043)	(0.592)	(0.315)	(0.162)
Controls	No	Yes	Yes	No	Yes	Yes
2nd period * controls	No	No	Yes	No	No	Yes
Observations	250	223	223	250	223	223
R^2	0.010	0.039	0.056	0.007	0.036	0.052
	Part II countries excluded; top and bottom terciles as treatment and control group					
	Quality-adjusted aid			Unadjusted aid		
2nd period * treatment	0.048	0.051	0.077*	0.029	0.056	0.069
	(0.180)	(0.180)	(0.070)	(0.415)	(0.160)	(0.114)
Controls	No	Yes	Yes	No	Yes	Yes
2nd period * controls	No	No	Yes	No	No	Yes
Observations	170	149	149	168	146	146
R^2	0.016	0.081	0.096	0.013	0.096	0.136

Robust pval in brackets; *** p<0.01, ** p<0.05, * p<0.1. We do not show results for the dummy variables for the 2nd period and the treatment group and the constant term to avoid clutter.

Table 4 – Effects of aid on the change in GDP per capita: delayed effects

	(1)	(2)	(3)	(4)	(5)	(6)
Variables	Total sample, lagged by one year					
	Quality-adjusted aid			Unadjusted aid		
2nd period * treatment	0.094***	0.091***	0.075**	0.051*	0.046	0.026
	(0.002)	(0.004)	(0.019)	(0.092)	(0.158)	(0.410)
Controls	No	Yes	Yes	No	Yes	Yes
2nd period * controls	No	No	Yes	No	No	Yes
Observations	286	238	238	286	238	238
R^2	0.039	0.047	0.066	0.009	0.027	0.053
	Total sample, lagged by two years					
	Quality-adjusted aid			Unadjusted aid		
2nd period * treatment	0.096***	0.098***	0.074**	0.056*	0.054	0.029
	(0.003)	(0.005)	(0.031)	(0.084)	(0.122)	(0.383)
Controls	No	Yes	Yes	No	Yes	Yes
2nd period * controls	No	No	Yes	No	No	Yes
Observations	286	238	238	286	238	238
R^2	0.049	0.056	0.078	0.020	0.037	0.066
	Total sample, lagged by three years					
	Quality-adjusted aid			Unadjusted aid		
2nd period * treatment	0.095***	0.106***	0.078**	0.057*	0.067*	0.039
	(0.005)	(0.004)	(0.030)	(0.090)	(0.072)	(0.272)
Controls	No	Yes	Yes	No	Yes	Yes
2nd period * controls	No	No	Yes	No	No	Yes
Observations	283	237	237	283	237	237
R^2	0.049	0.069	0.097	0.022	0.048	0.083
	Part II countries excluded; lagged by one year					
	Quality-adjusted aid			Unadjusted aid		
2nd period * treatment	0.057*	0.070**	0.071**	0.026	0.048	0.047
	(0.069)	(0.025)	(0.031)	(0.399)	(0.136)	(0.148)
Controls	No	Yes	Yes	No	Yes	Yes
2nd period * controls	No	No	Yes	No	No	Yes
Observations	248	223	223	248	223	223
R^2	0.011	0.038	0.053	0.004	0.030	0.048
	Part II countries excluded; lagged by two years					
	Quality-adjusted aid			Unadjusted aid		
2nd period * treatment	0.058*	0.071**	0.067**	0.023	0.043	0.038
	(0.087)	(0.037)	(0.049)	(0.500)	(0.224)	(0.266)
Controls	No	Yes	Yes	No	Yes	Yes
2nd period * controls	No	No	Yes	No	No	Yes
Observations	248	223	223	248	223	223
R^2	0.010	0.040	0.059	0.002	0.031	0.054
	Part II countries excluded; lagged by three years					
	Quality-adjusted aid			Unadjusted aid		
2nd period * treatment	0.066*	0.079**	0.076**	0.034	0.055	0.050
	(0.063)	(0.028)	(0.036)	(0.339)	(0.141)	(0.167)
Controls	No	Yes	Yes	No	Yes	Yes
2nd period * controls	No	No	Yes	No	No	Yes
Observations	247	222	222	247	222	222
R^2	0.014	0.047	0.074	0.005	0.038	0.068

Robust pval in brackets; *** p<0.01, ** p<0.05, * p<0.1. We do not show results for the dummy variables for the 2nd period and the treatment group and the constant term to avoid clutter.

Appendix table 1 – Definition of variables and data sources

Variable	Description	Source
2nd period	Dummy for treatment period (2005-2011)	Own definition
Treatment	Dummy for treatment group; see text for alternative definitions	Own definition
Unadjusted aid	Bilateral net ODA disbursements in constant 2012 US$	OECD DAC Statistics 2014
Quality-adjusted aid	Quality-adjusted aid in constant 2012 US$, as defined by Roodman (2012)	Own calculation based on Roodman (2012)
Change in (log) GDP per capita	Six year difference in logged GDP per capita in period 1: 2005-1999 and period 2: 2011-2005	Own calculation based on World Development Indicators (2015)
(log) GDP per capita	Natural log of GDP per capita (constant 2012 US$), first non-missing value in each period	World Development Indicators (2015)
Corruption	Control of corruption, first non-missing value in each period	World Development Indicators (2015)
(log) Inflation	Natural log of inflation, first non-missing value in each period	World Development Indicators (2015)
Openness	(exports + imports)/GDP, first non-missing value in each period	World Development Indicators (2015)
Multilateral aid	Share of multilateral aid in total aid	OECD DAC

Appendix table 2 – Descriptive statistics by treatment (T) and control (C) group (based on Table 1, columns (1)-(3), upper panel)

Variable	Observations	Mean	Std. dev.	Min	Max
2nd period T	144	1	1	0	1
2nd period C	144	1	1	0	1
Treatment T	144	1	0	1	1
Treatment C	144	0	0	0	0
Quality-adjusted aid (mean) T	144	218000000	246000000	0	1070000000
Quality-adjusted aid (mean) C	144	72700000	130000000	0	730000000
Quality-adjusted aid (difference) T	72	170000000	198000000	11700000	955000000
Quality-adjusted aid (difference) C	72	-26000000	69000000	-434000000	11600000
Change in (log) GDP per capita T	144	0.17	0.15	-0.44	0.55
Change in (log) GDP per capita C	144	0.14	0.18	-0.60	0.69
(log) GDP per capita T	142	7.27	1.04	5.43	9.43
(log) GDP per capita C	142	8.63	1.23	6.11	11.43
Corruption T	142	-0.54	0.58	-1.57	1.54
Corruption C	143	-0.06	0.80	-1.52	2.29
(log) Inflation T	140	2.04	1.07	-1.13	5.71
(log) Inflation C	121	1.52	0.99	-1.70	5.52
Openness T	140	74.06	37.44	20.98	270.36
Openness C	137	101.35	58.36	30.12	422.33
Multilateral aid T	143	33.83	18.48	0	100
Multilateral aid C	123	32.39	24.33	0	100

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